12358

TES Test Kinematic Mount Design Requirements

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EOS-Chemistry Project
NASA Goddard Space Flight Center
Greenbelt, MD 20771

Foreward & Approval Log

This document, TES Test Kinematic Mount Design Requirements, provides requirements for the development and delivery of the test kinematic mounts for the TES instrument. Requirements compliance will be verified with the delivery of the hardware.

This is an EOS Chemistry Project controlled document. Changes require prior approval of the Project Manager. Proposed changes shall be submitted to the EOS Chemistry Project Configuration Management Officer. Changes will be incorporated with bars in the margins and not tracked individually.

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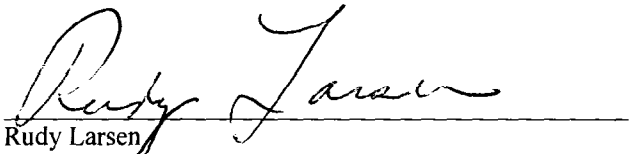
Approved by:  8/3/99

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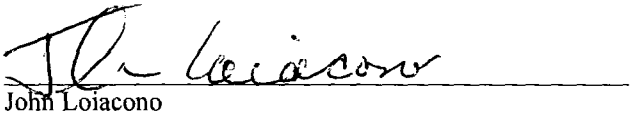
Approved by:  8/3/99

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1 INTRODUCTION

All of the EOS-Chemistry (CHEM) instruments are mounted to the spacecraft primary structure with kinematic mounts (KMs). These devices help to isolate the instrument from the spacecraft structurally and thermally. JPL's Tropospheric Emission Spectrometer (TES) is one of the EOS-Chemistry instruments with a test program and a requisite need for KMs in mechanical testing activity that is ahead of the development of the flight KMs by TRW, the prime contractor for the CHEM spacecraft. To fill this gap, the GSFC EOS Chemistry Project has authorized this document which specifies the requirements for the design, fabrication testing, and delivery of test kinematic mounts (TKMs) for the TES instrument. Upon successful completion of the TES TKM test program described below and in subsidiary documents, the CHEM Project shall authorize the use of the TKM's by JPL in the TES test program.

There are three types of mounts required by TES, as described in Table 1.1. The mounts shall be pseudo-kinematic flexures to keep the design simple and reduce overall cost. The geometry of the mounting interface is defined in the TES MID (ref. 1). It is a design goal that the mount designs be as flight-like as practical.

Table 1.1 TES Kinematic Mounts

Kinematic Mount type	Qty.
3 Degree of Restraint (3-DoR or KM3)	1
2 DoR (KM2)	1
1 DoR (KM1)	2

1.1 Responsibilites

The design and delivery of the TKMs (or mounts) shall be handled by Swales Aerospace Inc. (SAI) via contract NAS5-32650. Fabrication drawings and a draft analysis report shall be reviewed by the TES project at JPL prior to fabrication. Other contractors located at GSFC shall be enlisted to provide fabrication and testing services. Day-to-day management of the activity shall be the responsibility of SAI. The mounts shall be used for the testing of the TES instrument at JPL and returned to GSFC upon completion of the test program.

1.2 Schedule

The activity shall consist of three phases over approximately that many months. The first phase shall be a design phase, consisting of one or more iterations of the detailed design of the kinematic mounts. Phase two begins after the design has been accepted by JPL and fabrication at GSFC gets underway. Phase three is a testing phase that shall take place at GSFC. A baseline top-level schedule for the activity is included in the appendix.

2 DOCUMENTATION

2.1 Reference Documents

The documents in Table 2.1~~Table 2.1~~ are applicable to the development of the TES kinematic mounts to the extent described in this document.

Table 2.1 Reference Documents

Ref 1	TES Mechanical Interface Drawing	TRW MID # C326378
Ref 2	MLS GHz TKM Analysis Report	SAI Doc # SAI-ANYS-325
Ref 3	MLS GHz TKM Strength Test	SAI Doc # SAI-PLAN-304
Ref 4	MLS GHz TKM Modal Test	SAI Doc # SAI-PLAN-305
Ref. 5	EOS CHEM/MLS-GHz Kinematic Test Mounts Test Report	SAI Doc # SAI-RPT-274

2.2 Working Documents

The main product of phase one shall be a set of CAD-developed engineering drawings suitable for the fabrication of the test mounts. These shall evolve from 3D computer models developed in Pro-Engineer. Both sets of data files shall be provided to JPL during the design phase for planning purposes. Hardcopy engineering drawings officially recording the design shall be provided along with the hardware at delivery.

Analysis performed during phase one shall also be documented and released, preferably in a format suitable for inclusion as part of the final test report. An unverified 6 DOF equivalent stiffness matrix for each design shall be delivered to JPL once the design phase is over.

Phase two paper products shall include material and process certifications that shall accompany the delivered hardware to JPL.

Documentation to be completed during phase 3 shall include a test report with a verified 6 DOF equivalent stiffness matrix for each of the four mounts. This test report will follow the format of the comparable MLS report (ref 5.)

The MLS analysis report and test plans (refs. 2-4) are models for the format and contents of the TES analysis report and test plans. These TES specific reports shall be provided to JPL following their release from SAI.

Throughout the activity, a high level schedule shall be maintained by GSFC and updated on a regular basis.

3 REQUIREMENTS

3.1 Design Requirements

The geometry of the mounting interface is defined in the TES MID (ref. 1). It is a design goal that the mount designs be as flight-like as practical The mounts shall precisely match the flight KM mounting interfaces on the flight instrument structure. Heights of the test mounts shall be 6 inches or less.

Design limit loads are derived from the initial preliminary coupled loads cycle. For this CLA the mass of the TES model has been set at the maximum allowable mass. The mass was added such that only the interface loads and frequency on the KM's were effected. Factors of safety for the mounts shall be consistent with the GIRD, that is, 1.25 on yield and 1.4 on ultimate.

Stiffness of the mounts shall be high enough to meet the minimum resonant frequency requirement specified in Table 3.1 as directed in associated CHEM documentation.

Table 3.1 Instrument Stiffness Requirements

Structural Configuration	Minimum Fn
Instrument Fixed-base Frequency	> 50 Hz
Instrument and KM's coupled (fixed-base)	>45 Hz
Instrument and KM's coupled to S/C secondary structure	> 35 Hz

The fracture analysis shall use the test schedule specified in the GIRD in the development of the total lifetime load-cycle requirement.

3.2 Fabrication Requirements

Fabrication requirements shall be provided in the engineering drawing of the mounts.

3.3 Test Requirement

Modal and strength tests shall be performed on the individual mounts To facilitate the extraction of modes, the mounting fixtures for the modal survey tests shall have a reasonable degree of asymmetry. Additional detailed test requirements shall be provided in the SAI-developed test plans

Hardware certification shall begin before the test program with both dimensional and NDE crack inspections. These tests shall be repeated after testing to complete the certification process.

3.4 Delivery Requirements

Design data files shall be provided via the Internet to Enselmo Garcia at enselmo.garcia@jpl.nasa.gov. Final test and analysis documentation shall be delivered to:

Mr. Paul Rapacz, Building 157, Room 410, 4800 Oak Grove Drive, Pasadena, CA, 91109-8099

by mail no later than 4 weeks after hardware delivery. These items shall also be pre-released in electronic form in support of their test program to Mr. Paul Rapacz via the Internet at paul.rapacz@jpl.nasa.gov.

The mounts shall be delivered to Mr. Sergio Valdez, JPL, in support of the TES mechanical testing program, and baselined to be no later than October 1, 1999. The delivery address shall be:

Mr. Sergio Valdez, Building 158, Room 245, 4800 Oak Grove Drive, Pasadena, CA, 91109-8099

Mounting fasteners shall not be provided to JPL with the TKM's.

APPENDIX

Baseline Schedule for TES Instrument TKM Development

TES Test Kinematic Mounts Schedule
(baseline)

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